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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/565,902	01/25/2006	Akira Suzuki	Q92405	7356

65565 7590 04/28/2009

SUGHRUE-265550
2100 PENNSYLVANIA AVE. NW
WASHINGTON, DC 20037-3213

EXAMINER	
SANTIAGO, MARICELI	

ART UNIT	PAPER NUMBER
2879	

MAIL DATE	DELIVERY MODE
04/28/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/565,902	SUZUKI ET AL.	
	Examiner	Art Unit	
	Mariceli Santiago	2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 April 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/28/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Claims 1-12 are pending in the instant application.

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), and further in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880).

Regarding claim 1, Oshima discloses a method for producing a spark plug including a center electrode (3), an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion to which a columnar noble metal tip facing the center electrode is welded, the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of a noble metal tip (12) to thereby form a flange portion (14) having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17, Fig. 6) the noble metal tip to the electrode in such a manner that a laser beam is applied on the whole circumference of the flange portion (14) of the noble metal tip. Although,

Oshima exemplifies the above welding processes for the manufacture of the noble metal tip on the center electrode, it is considered within the teachings of Oshima to use the same processes and welding techniques for welding a noble tip on the ground electrode with similar same expectations of success.

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60% or higher.

In the same field of endeavor, Osamura discloses a method for producing a spark plug by laser welding a noble metal tip to an electrode, and further exemplifies adjusting the noble metal content within a junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), which suppresses internal thermal stress and prevents peeling or cracking of the junction between electrode and noble tip.

Oshima in view of Osamura fails to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer (fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation angle increases the amount of noble metal tip content in the junction layer, thereby decreasing

the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the combination of the noble metal tip content taught by Osamura and the irradiation angle taught by Hori in the method of Oshima in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Regarding claim 2, Oshima discloses a method for producing a spark plug including a center electrode (3) having a front end portion to which a columnar noble metal tip (12) is welded, an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion facing the center electrode, the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of the noble metal tip (12) on a side opposite to a counter surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode to thereby form a flange (14) portion having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17. Fig. 5) the noble metal tip (12) to the center electrode (3) in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip (Fig. 5).

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the front end portion of the center electrode and the noble metal tip from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher.

However, in the same field of endeavor, Osamura discloses a method for producing a spark plug by adjusting the noble metal content within the junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the center electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Oshima in view of Osamura fails to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer (fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation angle increases the amount of noble metal tip content in the junction layer, thereby decreasing the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the combination of the noble metal tip content taught by Osamura and the irradiation angle taught by Hori in the method of Oshima in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the

noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), in view of Kondo et al. (US 4,540,910), and further in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880).

Regarding claim 4, Oshima discloses a method for producing a spark plug including a center electrode (3), an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion to which a columnar noble metal tip facing the center electrode the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of a noble metal tip (12) to thereby form a flange portion (14) having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17, Fig. 6) the noble metal tip to the electrode in such a manner that a laser beam is applied on the whole circumference of the flange portion (14) of the noble metal tip. Although, Oshima exemplifies the above welding processes for the manufacture of the noble metal tip on the center electrode, it is considered within the teachings of Oshima to use the same processes and

welding techniques for welding a noble tip on the ground electrode with similar expectations of success.

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60% or higher.

However, in the same field of endeavor, Osamura discloses a method for producing a spark plug by adjusting the noble metal content within the junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the noble metal content in the junction layer disclosed by Osamura in the method of Oshima in order to suppress internal thermal stress within the junction layer and prevent peeling or cracking of the junction between electrode and noble tip.

The combined references to Oshima in view of Osamura fail to exemplify the limitation of providing a seat tip joined to the front end portion of the ground electrode and having a thermal expansion coefficient between that of the noble metal tip and that the electrode.

In the same field of endeavor, Kondo discloses a method for producing a spark plug further comprising a seat tip joined to the front end portion of the center electrode (Column 3, lines 50-59) and having a thermal expansion coefficient between that of the noble metal tip and

that the electrode (Column 6, lines 28-50), the seat tip acts as a stress relieving layer to adjust the thermal expansion coefficient between the noble metal tip and the electrode main body in order to prevent cracking and peeling off of the noble meal tip. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the seat tip disclosed by Kondo in the method of Oshima in view of Osamura in order to provide a stress relieving layer which adjust the thermal expansion coefficient between the noble metal tip and the electrode main body to prevent cracking and peeling off of the noble meal tip.

The references to Oshima, Osamura and Kondo fail to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer (fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation angle increases the amount of noble metal tip content in the junction layer, thereby decreasing the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the irradiation

angle taught by Hori in the combined method of Oshima, Osamura and Kondo in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Regarding claim 5, Oshima discloses a method for producing a spark plug including a center electrode (3) having a front end portion to which a columnar noble metal tip (12), an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion facing the center electrode, the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of the noble metal tip (12) on a side opposite to a counter surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode to thereby form a flange portion (14) having a swollen outer

diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17, Fig. 5) the noble metal tip to the center electrode welding in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip.

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60% or higher.

However, in the same field of endeavor, Osamura discloses a method for producing a spark plug by adjusting the noble metal content within the junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the noble metal content in the junction layer disclosed by Osamura in the method of Oshima in order to suppress internal thermal stress within the junction layer and prevent peeling or cracking of the junction between electrode and noble tip.

The combined references to Oshima in view of Osamura fail to exemplify the limitation of providing a seat tip joined to the front end portion of the center electrode and having a thermal expansion coefficient between that of the noble metal tip and that the electrode. In the same field of endeavor, Kondo discloses a method for producing a spark plug further comprising a seat tip joined to the front end portion of the center electrode (Column 3, lines 50-59) and

having a thermal expansion coefficient between that of the noble metal tip and that the electrode (Column 6, lines 28-50), the seat tip acts as a stress relieving layer to adjust the thermal expansion coefficient between the noble metal tip and the electrode main body in order to prevent cracking and peeling off of the noble meal tip. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the seat tip disclosed by Kondo in the method of Oshima in view of Osamura in order to provide a stress relieving layer which adjust the thermal expansion coefficient between the noble metal tip and the electrode main body to prevent cracking and peeling off of the noble meal tip.

The references to Oshima, Osamura and Kondo fail to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer (fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation angle increases the amount of noble metal tip content in the junction layer, thereby decreasing the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the irradiation

angle taught by Hori in the combined method of Oshima, Osamura and Kondo in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), in view of Katoh et al. (US 5,465,022), and further in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880).

Regarding claim 6, Oshima discloses a method for producing a spark plug including a center electrode (3), an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion to which a columnar noble metal tip

facing the center electrode the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of a noble metal tip (12) to thereby form a flange portion (14) having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17, Fig. 6) the noble metal tip to the electrode in such a manner that a laser beam is applied on the whole circumference of the flange portion (14) of the noble metal tip. Although, Oshima exemplifies the above welding processes for the manufacture of the noble metal tip on the center electrode, it is considered within the teachings of Oshima to use the same processes and welding techniques for welding a noble tip on the ground electrode with similar expectations of success.

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60% or higher.

However, in the same field of endeavor, Osamura discloses a method for producing a spark plug by adjusting the noble metal content within the junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the noble metal content in the junction layer disclosed by Osamura in the method of Oshima in order to suppress internal thermal stress

within the junction layer and prevent peeling or cracking of the junction between electrode and noble tip.

The combined references to Oshima in view of Osamura fail to exemplify the limitation of providing a seat tip joined to a bottom surface of the noble metal tip on a side opposite to a counter surface of the noble metal tip to an inner surface of the other end portion of the ground electrode on a side opposite to the center electrode, and having a thermal expansion coefficient between that of the noble metal tip and that the electrode.

However, in the same field of endeavor, Katoh discloses a method for producing a spark plug provided with a pre-formed composite noble metal tip (Fig. 9) comprising a noble metal tip (11C) and a seat tip (19C) joined to bottom surface of the noble metal tip, the seat tip acts as a stress relieving layer having a thermal expansion coefficient between that of the noble metal tip and that the electrode in order to reduce the thermal stress between the metal chip and the electrode main body (Column 21, lines 1-41). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the seat tip layer disclosed by Katoh in the method of Oshima in view of Osamura in order to provide a thermal stress relieving layer to reduce the thermal stress between the metal chip and the electrode main body.

The references to Oshima, Osamura and Katoh fail to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer (fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation

angle increases the amount of noble metal tip content in the junction layer, thereby decreasing the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the irradiation angle taught by Hori in the combined method of Oshima, Osamura and Katoh in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Regarding claim 7, Oshima discloses a method for producing a spark plug including a center electrode (3) having a front end portion to which a columnar noble metal tip (12), an insulator (2) having an axial hole in an axial direction for holding the center electrode on a front end side of the axial hole, a metal shell (6) for holding the insulator while surrounding the circumference of the insulator, and a ground electrode (7) having one end portion joined to the metal shell, and the other end portion facing the center electrode, the method comprising the steps of resistance-welding (Fig. 5) a bottom surface of the noble metal tip (12) on a side opposite to a counter surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode to thereby form a flange portion (14) having a swollen outer diameter of the noble metal tip in a bottom portion of the noble metal tip, and welding (17, Fig. 5) the noble metal tip to the center electrode welding in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip.

Oshima is silent in regards to the limitation of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60% or higher.

However, in the same field of endeavor, Osamura discloses a method for producing a spark plug by adjusting the noble metal content within the junction layer between the electrode and the noble metal tip, wherein content of the noble metal content in a position far by about 0.05 mm inward a molten portion between the noble metal tip and the other end portion of the ground electrode from a boundary surface between the molten portion and a non-molten portion of the noble metal tip becomes 60 % or higher (Column 13, lines 19-52), in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip. Thus, it would have been obvious at the time the invention was made to a person

having ordinary skills in the art to incorporate the noble metal content in the junction layer disclosed by Osamura in the method of Oshima in order to suppress internal thermal stress within the junction layer and prevent peeling or cracking of the junction between electrode and noble tip.

The combined references to Oshima in view of Osamura fail to exemplify the limitation of providing a seat tip joined to a bottom surface of the noble metal tip facing the ground electrode to the front end portion of the center electrode, and having a thermal expansion coefficient between that of the noble metal tip and that the electrode.

However, in the same field of endeavor, Katoh discloses a method for producing a spark plug provided with a pre-formed composite noble metal tip (Fig. 9) comprising a noble metal tip (11C) and a seat tip (19C) joined to bottom surface of the noble metal tip, the seat tip acts as a stress relieving layer having a thermal expansion coefficient between that of the noble metal tip and that the electrode in order to reduce the thermal stress between the metal chip and the electrode main body (Column 21, lines 1-41). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the seat tip layer disclosed by Katoh in the method of Oshima in view of Osamura in order to provide a thermal stress relieving layer to reduce the thermal stress between the metal chip and the electrode main body.

The references to Oshima, Osamura and Katoh fail to exemplify the limitation of the laser welding being performed obliquely at an angle to both the side surface of the noble metal tip and the surface of the electrode.

In the same field of endeavor, Hori discloses a method for producing a spark plug by laser welding a noble metal tip (44) to an electrode (40), and further exemplifies that adjusting the irradiation angle (≤60°, ¶[0011]) controls the noble metal content within a junction layer

(fused portion 44) to increase the joint strength. Hori discloses that a decrease in the irradiation angle increases the amount of noble metal tip content in the junction layer, thereby decreasing the thermal stress acting on the boundary surfaces between the tip and the junction layer and increasing the joint strength (¶[0110]). Accordingly, one skilled in the art would reasonable contemplate using the known technique of adjusting the irradiation angle to control the noble metal tip content within the junction layer as taught by Hori in order to achieve the noble metal tip content taught by Osamura, since both references are concerned with controlling the noble metal tip content within the junction layer and such combination would have yield the predictable results of increasing the joint strength. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the irradiation angle taught by Hori in the combined method of Oshima, Osamura and Katoh in order to suppress internal thermal stress and prevent peeling or cracking of the junction between electrode and noble tip.

Hori fails to exemplify the obliquely inclined laser beam being applied on the whole circumference of the flange portion, instead the laser beam is applied to multiple spaced regions around the circumference. However, in the same field of endeavor, Abe discloses a method for producing a spark plug using laser welding to attach the noble metal tip to the electrode element by using an obliquely inclined laser beam (L, Fig. 3b) to the whole circumference (Fig. 3d) of the noble metal tip, or alternatively, to multiple spaced regions around the circumference of the noble metal tip (Fig. 3e). Abe acknowledges that both welding techniques yield similar results of alleviating the thermal stress between the electrode and the noble metal tip. Accordingly, it would have been obvious to one of ordinary skills in the art at the time the invention was made to provide the laser beam along the entire circumference of the tip instead of spaced region

along the circumference, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art as evidenced by Abe's teaching.

Claims 3 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880), and further in view of Yamaguchi et al. (US 4,700,103).

Regarding claims 3 and 9, the combined references to Oshima in view of Osamura fail to exemplify the limitation of the noble metal tip is resistance-welded so that the sectional area of the flange portion in the axial direction of the noble metal tip is not smaller than 1.3 times as large as the area of the counter surface. However, in the same field of endeavor, Yamaguchi discloses a method for producing a spark plug comprising the step of resistance-welding a bottom surface of a noble metal tip to thereby form a flange portion having a swollen outer diameter of the noble tip in a bottom portion of the noble metal tip, wherein the sectional area of the flange portion (calculated from diameter B, Fig. 3) in the axial direction of the noble metal tip is not smaller than 1.3 times as large as the area of the counter surface (calculated from diameter A, Fig. 3), Yamaguchi discloses the relationship B ≥ 1.2 A (Column 5, lines 55-58), thus the area of the flange potion will consequently be at least 1.2 times greater than the area of the counter surface, the disclosed arrangement provides a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the area relationship disclosed by Yamaguchi in the method of Oshima in view of Osamura in order to provide a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), in view of Kondo et al. (US 4,540,910), in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880), and further in view of Yamaguchi et al. (US 4,700,103).

Regarding claims 8 and 10, the combined references to Oshima in view of Osamura-Kondo fail to exemplify the limitation of the noble metal tip is resistance-welded so that the sectional area of the flange portion in the axial direction of the noble metal tip is not smaller than 1.2 times as large as the area of the counter surface. However, in the same field of endeavor, Yamaguchi discloses a method for producing a spark plug comprising the step of resistance-welding a bottom surface of a noble metal tip to thereby form a flange portion having a swollen outer diameter of the noble tip in a bottom portion of the noble metal tip, wherein the sectional area of the flange portion (calculated from diameter B, Fig. 3) in the axial direction of the noble metal tip is not smaller than 1.2 times as large as the area of the counter surface (calculated from diameter A, Fig. 3), Yamaguchi discloses the relationship $B \geq 1.2 A$ (Column 5, lines 55-58), thus the area of the flange potion will consequently be at least 1.2 times greater than the area of the counter surface, the disclosed arrangement provides a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the area relationship disclosed by Yamaguchi in the method of Oshima in view of Osamura-Kondo in order to provide a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima (JP 07-022155 A) in view of Osamura (US 6,215,235), in view of Katoh et al. (US

5,465,022), in view of Hori et al. (US 2002/0105254) in view of Abe et at. (JP 09-106880) and further in view of Yamaguchi et al. (US 4,700,103).

Regarding claims 11 and 12, the combined references to Oshima in view of Osamura-Katoh fail to exemplify the limitation of the noble metal tip is resistance-welded so that the sectional area of the flange portion in the axial direction of the noble metal tip is not smaller than 1.2 times as large as the area of the counter surface. However, in the same field of endeavor, Yamaguchi discloses a method for producing a spark plug comprising the step of resistance-welding a bottom surface of a noble metal tip to thereby form a flange portion having a swollen outer diameter of the noble tip in a bottom portion of the noble metal tip, wherein the sectional area of the flange portion (calculated from diameter B, Fig. 3) in the axial direction of the noble metal tip is not smaller than 1.2 times as large as the area of the counter surface (calculated from diameter A, Fig. 3), Yamaguchi discloses the relationship B ≥ 1.2 A (Column 5, lines 55-58), thus the area of the flange potion will consequently be at least 1.2 times greater than the area of the counter surface, the disclosed arrangement provides a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the area relationship disclosed by Yamaguchi in the method of Oshima in view of Osamura-Katoh in order to provide a satisfactory welded joint strength which prevents separation of the noble tips from the electrode main body.

Response to Arguments

Applicant's arguments with respect to claims 1-12 have been considered but are moot in view of the new ground(s) of rejection.

The final office action, mailed January 2, 2009, was necessitated by applicant's amendment, however, upon applicant's request for reconsideration the finality of the office action has been withdrawn, thus that action is considered a non-final rejection. Accordingly, **THIS ACTION IS MADE FINAL**, since the new grounds of rejection presented in this office action were necessitated by applicant's previous amendment filed September 26, 2008. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mariceli Santiago whose telephone number is (571) 272-2464. The examiner can normally be reached on Monday-Friday from 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (571) 272-2457. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Mariceli Santiago/
Primary Examiner, Art Unit 2879